SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Project Management Plan

The project plan is a document that authorizes the project manager to apply organizational resources to project activities and to proceed with executing and controlling the project plan.

Project Title: AHED Task 2: Detailed Design and Implementation of Enhanced Arc Hydro Enterprise Geodatabase

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Consulting Chief Researcher: Dr. David Maidment, CRWR

Project Sponsor(s): Chris Carlson, Ken Stewart, Ken Konyha, Jayantha Obeysekera

Level of Empowerment:

This project plan has been initiated by SFWMD and authorizes the project manager to expend [*District* | *Department* | *Division*] resources to execute this project plan for the Enhanced Arc Hydro Enterprise Database Implementation.

Approvals:

Project Sponsor	Date
Other Approving Authority, if needed	Date

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Project Scope:

The Enhanced ArcHydro Enterprise Database (AHED) is an outgrowth of South Florida Water Management District's (the District) goal of building a common data framework for Scientific Water Management--a framework that is shared by key projects to fulfill the District's mission statement. The final goal of AHED Task 2 is physical implementation of the conceptual model developed in Task 1. The conceptual model and requirements definition completed in Task 1 represent the collaboration of government, academic and private consulting resources to provide new and innovative approaches and data structures for Water Resources modeling in GIS, tuned for the unique environments of South Florida. New and powerful concepts that integrate the needs of operations, environmental restoration, flood mitigation, and modeling have emerged from the Task 1 collaboration and Task 2 is where these exciting new concepts will be detailed, implemented and tested. The collaborators, all of whom will continue to be involved in Task 2, are listed in the Communications Plan of this document. They include District stakeholders from the disciplines cited above, the University of Texas at Austin-Center for Research in Water Resources (CRWR) and PBS&J consulting.

The Task 2 implementation will ultimately be as an Enterprise geodatabase and toolbox under ArcGIS 9.0 and ArcSDE 9.0 at the District. Key activities to implement the Task 1 Conceptual Design in accordance with the Task 1 Requirements Definition include:

- Implement the conceptual model in an ArcGIS 9.0 framework geodatabase (initially a personal geodatabase and detailed ESRI geodatabase UML model)
- Work with stakeholders to identify key common attributes to expand the conceptual framework and carefully expand the core through several iterations (approx. 10 weeks) of testing and review using prototype datasets from each discipline (ensuring the product meets the Task 1 requirements)
- Implement the core AHED framework in Oracle under ArcSDE 9.0 with the tools and procedures required by the district to:
    - fully populate and maintain the framework layers
    - build the necessary relationships between individual features on different layers
    - provide links to key external databases
    - handle spatially referenced heads and flows in time series formats
    - provide the means for adding new relationships, layers, and attributes as the framework evolves.
- Provide training to District staff in the database design principals and details, and in the use of the tools and procedures to update and maintain the data.

Detailed Task 2 requirements identified in Task 1 include the following:

1. The Enhanced Arc Hydro Geodatabase must support the following specific needs for South Florida. Items 1.1 – 1.4 are already supported by standard Arc Hydro:
   - 1.1. Provide a framework to integrate multiple hydrologic layers and maintain relationships between layers. (For example linking gages to their water bodies and to their basins).
   - 1.2. Support a non-dendritic hydrologic network with user-defined flow-reversals. Support for linking to a future system that provides dynamically-defined flow direction.
   - 1.3. Be compatible with a system for distributed data maintenance based on assignment of data stewards.
   - 1.4. Support a unique HydroID for every feature in the District, subdivided by basin (Currently supports up to 428 basins with up to 10 million features each, or 4289 basins with 1 million features each).
   - 1.5. Include support for special geographic features and attributes of the South Florida hydrologic system as identified in individual project data requirements. Examples are ASR wells, and linear conduit that cannot be modeled as open channel under flood conditions.
   - 1.6. Provide a time-series framework to integrate point time-series, time-indexed grids, and time-series defined on features.
   - 1.7. Provide "hooks" and strategies to link with time-series data that are stored in existing Database Management Systems (DBMS). Examples: Rainfall, Gage data, SCADA output.
   - 1.8. Provide time-indexed geographic features. Because so much of the South Florida hydrologic/hydraulic environment is manmade, it is important to maintain beginning and ending dates of service, similar to a Utility, as well as the dates that geographic features are created and destroyed.
   - 1.9. Provides Linear Referencing. The network of canals and channels frequently needs to be subdivided in different ways depending on the project and the scale. Linear referencing is the best method for attaching multiple sets of data to dynamically measured portions of a single network.
   - 1.10. Data Certification. The geodatabase will address the specific data quality and data certification needs of a scientifically-based water management system. Examples:
     - 1.10.1. There are many data layers that will be entered and maintained from a variety of sources. Relative quality of individual records or record groupings need to be assessed to resolve conflicts between data layers
     - 1.10.2. The framework structure will accommodate record-level metadata to support data certification for use at different scales and/or for different common applications. Record level metadata will not be populated as part of this task.
     - 1.10.3. Strategies and technical criteria for future record-level metadata application development will be provided.

1.11. Support for maintenance of historic "snapshots" of portions of the Enterprise geodatabase for project archives or for developing "what-if" scenarios.

1.12. The geodatabase will be accessible using standard DBMS toolsets as well as through ArcGIS.

2. The project must provide an Enhanced Arc Hydro Toolset for data input and maintenance that meets the following goals:
   2.1. Adapt tools from the Arc Hydro Toolset so that they work on the Enhanced Arc Hydro framework.
   2.2. Support import/export by translation table.
   2.3. Automate assignment, and uniqueness/connectivity/consistency checks of HydroID.
   2.4. Support Check-out and Check-in of data by Basin and synchronizing HydroID.

3. The Enhanced Arc Hydro geodatabase will provide a framework for shared hydrologic information in support of Scientific Water Resources Management that meets the following goals:
   3.1. The hydrologic framework will be structured to address water balances, heads and flows as the key hydrologic data to superimpose on the geographic data.
   3.2. The hydrologic framework will include links to the source data to permit review of inputs and methodologies (e.g. which model was used).
   3.3. The hydrologic framework will be structured to permit comparison of water balances and to allow conservation of mass calculations. This includes comparison between different sources for the same location and time step. For example the volume of water in a canal as indicated by operations and as modeled by Flood Control.
   3.4. The framework will permit the investigation of the effectiveness of the gage network, and the extent to which adding or removing gages will change the precision of water management. Gage network evaluation will be performed using geostatistics functionality of ESRI Statistical Analyst-implementation as part of future task development.
   3.5. The framework will provide a standardized mechanism through the design of customized model interface geodatabases, for the integration of other hydrologic models and components not presently a part of the Four Projects.

The following list represents key functions that must ultimately be supported by the Enhanced Arc Hydro Geodatabase. The extent that each function is addressed in Task 2 is described in italics. The list was established by prioritizing the functional requirements and matching to the available budget for Task 2.

- The capacity to develop and maintain a portion of the geodatabase for a sub-region of the district, and then to smoothly integrate that with the district-wide geodatabase. *This is part of disconnected editing. It is to be implemented and tested during Task 2.*

- The ability for project-level geodatabases to use more detailed spatial information than a subregional or district level geodatabase, and be able to exchange hydrologic information with sub-regional or district level geodatabases. *Project-level geodatabases are not part of Task 2. Task 2 will provide the hooks and specifications for these interactions.*
- The ability to have district-wide spatially distributed water balancing, as provided for by the RSM model, to be an input to other models and analyses, including the ODSS, Hydroperiod tools and flood management. *While the project-level geodatabases and model interfaces are not part of Task 2, the framework and attributes to store sufficient hydrologic information in Enhanced Arc Hydro to permit water balancing is a part of Task 2.*
- The capacity to define from gage-adjusted radar rainfall information the amount of rain falling in the drainage area contributing to each water control unit. *The capacity to implement this feature as a tool will be included in Task 2, generalized to include distribution of many types of hydrologic data to user-defined drainage areas. A tool to assign gage-adjusted radar rainfall to the contributing drainage area of a WCU is priority 2*
- The construction of water control unit "systems" which connect all the spatial features influencing the performance of a particular water control unit. *The relationships to define these systems will be included in Task 2.*
- Support for hydrologic and hydraulic modeling of water heads and flows through the drainage areas and water control units. This will be by using the RSM model for planning purposes, and by using this model or others for operational purposes. Specific Interfaces with hydrologic and hydraulic modeling tables and/or project geodatabases are not part of Task 2. Task 2 will provide the Enhanced Arc Hydro geodatabase with geographic and network features required for modeling, with attributes such as length and slope that are common to all models, and with hooks to timeseries so that heads and flows can be linked to Arc Hydro features.
- Support for flood management and planning during extreme events, including historical storms, and standard design flood events. This will include the linkage of the extended Arc Hydro framework to standard flood hydrology models, such as XP-SWMM, and perhaps later the HEC and DHI flood modeling systems. Task 2 will implement Enhanced Arc Hydro with the capacity and data structures to link geographic features with model results to show heads and flows. Actual links to models and/or live results for flood management and planning will be implemented during future tasks.
- The capacity to transform time series data from recorded time series in the external database systems to time series of map attributes, grids and feature classes, such as inundation maps. All these functions are needed to support the computation of statistics, graphs and maps of hydroperiods and hydropatterns of wetland inundation. These tools are to be developed as part of Tasks 3 for those time series required specifically for Hydroperiod. Task 2 will include the data structures for linking from Arc Hydro to an example Enterprise database (DBhydro) and a generalized methodology for linking to other Enterprise databases.

- The ability to link and compare time series produced by hydrologic models and those measured at gages to calibrate and validate model performance. Task 2 will provide the hooks and data structures to perform these comparisons. The tool to import Monitoring Station time-series to Arc Hydro is a high priority item that will be implemented during Task 3 in parallel with Task 2. Interfaces to model results are for future tasks.
- Spatial and autocorrelation statistics under future tasks.

Related Projects:

Task 2 will be implemented in parallel or overlapping with several related AHED tasks. To ensure there is a minimum of duplication and a maximum of cooperation the following description spells out what each task is expected to contribute. In addition, the project Communication Plan provides a structure in which all existing and future AHED tasks can be coordinated.

- AHED Task 1: AHED Requirements Definition and Conceptual Design. *Completed Dec. 1, 2003.*
- AHED Task 2 (this task): AHED Detailed Design and Implementation of Database and Toolbox. *Workorder signed Dec. 22, 2003. Kickoff meeting Jan 6, 2004.*
- AHED Task 3: AHED Hydroperiod Toolbox and Automated Procedures. *Workorder 3 Revision 2 submitted January 30, 2004. (Execution date:Feb 16, 2004)*
- AHED Task 4: AHED H&H Extension: FEMA-Compatible Standard H&H Detail Project Geodatabase and Automated Standards and Quality Control Tools Linked to AHED. *Workorder 4 Submitted January 30, 2004 (Execution date to be determined)*
- AHED Task 5: AHED/ODSS/OASys Interoperational System Architecture and ArcSDE Prototype. *Final Scope submittal to be determined.*

The combined affect of the tasks will be:

Task 2 to implement the conceptual geodatabase design from Task 1 as a detailed geodatabase and toolset that meet the Task 1 Requirements Definition. Work with stakeholders to identify key common attributes within the conceptual framework and implement the core AHED framework with the tools and procedures required to populate the framework layers, to build the necessary relationships between layers and to key external databases, to handle spatially referenced heads and flows in time series formats, and to provide the means for adding new relationships, layers, and attributes as the framework evolves.

Task 2 Tools: Assign HydroID; Generate From/To Node for Lines; Find Next Downstream Line; Calculate Length Downstream for Edges; Calculate Length Downstream for Junctions; Find Next Downstream Junction; Hydro Network Generation; Store Flow Direction; Set Flow Direction; Global Point Delineation Button; Import/Export by Translation Table; Update Hydro-ID; Check in/Check out Watershed

Task 3 to implement the GIS tools and automate procedures for accessing the AHED geodatabase and the required extensions and analysis results in order to perform Hydroperiod analysis. General applicability -- expand integration of timeseries with spatial data, add new tools for surface interpolation and timeseries analysis.
Task 3 Tools: Import DBHydro Hydraulic Head Measures to AHED Timeseries; Tools to extrapolate time-varying inundation maps and estimates of the volume of water in the flooded areas. Associate TimeSeries data with Hydroperiod point features; Interpolate a water surface for the floodplain; Create ponded depth grids; Generate Ponded depth statistics using Zonal Statistics; Classify ponded depth values according to user defined classifications.

Task 4 to implement a geodatabase design and tools for storing and reviewing Hydrologic and Hydraulic model data in GIS. The design is linked to the AHED framework, and compatible with the requirements of both FEMA study review and FEMA DFIRM production.
Task 4 Tools: GIS tools and procedures for South FL Topographic Data QA/QC; Import Tools for Watershed Flood Modeling geodatabase and Interface to AHED Geodatabase; Tools and Standards for Model Review/Model Water Balance Checking/Quality Scoring; Tool for Export to Expanded DFIRM format or future equivalent.

Task 5 to implement a geodatabase server architecture and associated tools to support the Operational Decision Support System (ODSS) and OASys and to integrate with the AHED framework. Key goals are maximizing shared data and capabilities, minimizing duplication of effort or different GIS representations of the same feature between AHED and ODSS, maintaining enforced topology on the GIS representation of the system and creating a capability to do water balancing within the Water Control Units of the ODSS.
Task 5 Tools: AHED Interface Application-Publish Real-time Data to AHED; Define WCU; Define WCS; Define Drainage Area; Hydraulic Model Interface Application; Water Conveyance Routing Tool; Other Tools To Be Determined.

Work Breakdown Structure:

Task 2.1 – Development, Operating, and Maintenance Environment Overview

Simultaneous to prototyping of the data model, the District and the contractor will collaborate to exchange relevant information required to facilitate implementation of the AHED model. This will be an iterative process of information gathering, processing and review that will culminate in a final document intended to aid the contractor in implementing the AHED model within the District's Information Technology and Enterprise GIS environment. The contractor is also encouraged to make suggestions regarding optimal system configuration.

Task 2.1 Deliverable: Environment Overview Document

One (1) draft electronic copy in MS Word or other MS Office format shall be delivered to the contractor for review. The contractor will have five working days to review the document before submitting to the District for finalization. Final submittal date will be specified in the Task 2 work plan.

Task 2.2 –AHED Coordination and Planning Meeting

PBS&J will attend an AHED Coordination and Planning meeting to be held at the DISTRICT. PBS&J will submit an agenda to the District two weeks prior to the meeting in order to allow the District time to identify and select critical meeting staff. The meeting will be attended by PBS&J and the District's project management team and include key personnel from the IT and GIS groups. PBS&J will present a synthesis of information gathered during task 1.2 Requirements Definition relevant to Task 2 objectives regarding District hardware, software, performance, firmware, and interface requirements.

The meeting will address project items listed below:

- Required resources to implement the AHED model
- Definition of tasks outlining contractor and District responsibilities
- Project protocol that includes a problem resolution process, and documentation procedures

A final work plan will incorporate issues and information gathered at the meeting and will include a project deliverable schedule, status reporting process, protocol document and communication plan. A final draft will be agreed upon by all participants.

Task 2.2 Deliverable: Final Project Work Plan and Deliverable Schedule

One (1) electronic copy in MS Word or other MS Office format and five (5) hardcopies of District reviewed and approved work plan shall be delivered to the DISTRICT within eight working days of the meeting.

Task 2.3 Development and Implementation of the AHED

This task entails development of the AHED Model per design issues of programming languages, operating systems, and relational databases in the context of the requirement specifications and a conceptual plan design of Task 1. An AHED toolbox will be developed in conjunction with the AHED geodatabase to facilitate data loading, verification, and data access. The contractor will utilize industry standard software development lifecycle process and documentation procedures to complete this task.

The conceptual framework for the AHED Model will serve as the common foundation framework for Arc Hydro implementation at the DISTRICT. Future projects will further extend this framework to meet project specific requirements. A methodology for extending the core enterprise model to meet application specific requirements will need to be defined in Task 2 and implemented in Task 3. The contractor will also be responsible for presenting a review process that will ensure consistency and connectivity between the core and application specific data models. The contractor will also provide procedures to keep AHED synchronized with future modifications to the National ArcHydro Data Model.

Through the entire Task 2 process, the PBS&J/UT team will perform testing and acceptance verification of units of the AHED. Sample data sets as referenced in the Task 1 Conceptual Design and in Appendix A, will be loaded to "ground truth" the database design and the AHED Toolbox. Milestones for the verification testing process will be incorporated into the design, building and implementation Task 2.

Task 2.3.1 AHED Model Logical Design

The logical design will encompass building database elements from the conceptual design using Unified Modeling Language (UML) and will incorporate the attribute details required to meet the design goals and specifications identified in Task 1. Model logical design will include prototyping of the conceptual framework and making modifications based on prototype implementations. The detailed AHED design will be documented in UML using Microsoft Visio. The final version of the logical model will be delivered in Visio UML format that is capable of implementation within a personal or SDE geodatabase using case tools. Specifications for the AHED toolbox and data loading will also be documented as part of Task 2.3.4 and submitted in conjunction with Task 2.3.1 deliverables.

Sub-task 2.3.2.1: An initial deliverable (2.3.1.1) of a prototype AHED personal geodatabase derived from the Conceptual Model will be provided to the District at the

Coordination Meeting. The 2.3.1.1 deliverable is intended to initiate iterative review and feedback during the detailed database development and selection of common attributes to be included in the core AHED model. Geodatabase Version control during the iterative development phase is included in the Communications Plan of this document.

Sub-task 2.3.1.2: After no less than two months of iterative review and bi-weekly feedback the final AHED geodatabase design will be established and prepared for the final 2.3.1.2 Deliverable.

The District will establish a team of reviewers and data stewards to review the geodatabase design in relation to existing datasets and identify common attributes that are needed to support the reviewers' data needs. PBS&J will provide an initial half-day session to the reviewers in the database design and logical relationships. As a means to organize additional attributes (or optionally data layers), the reviewers will be provided with an Excel spreadsheet template for each AHED dataset listing the current attributes in the shared core AHED geodatabase. The spreadsheets will include the fields needed to describe recommendations for additional attributes or layers.

The compiled spreadsheet recommendations of the review team will be provided to PBS&J by the District Project Task Manager, and these sheets will be used to guide development of intermediate products by PBS&J during the review period.

As part of the final Task 2.3.1 deliverable, and in addition to delivery of the UML design for 2.3.1.2, documentation will be provided that includes the following:

- Detailed documentation on the design and functions of the hooks and links incorporated into the framework based on task 1 goals.
- A strategy for database connectivity and consistency between the AHED framework and individual project geodatabases.
- A strategy for extending the AHED framework model to support application development for each of the participating projects.
- Procedures for AHED synchronization with the national Arc Hydro geodatabase model.
- Strategy and technical specifications for implementing model components such as linear referencing, time-indexed spatial features, and disconnected editing.

Task 2.3.1.1 Deliverable: Prototype Geodatabase

The first Task 2.3.1 milestone will be delivery of an initial geodatabase, as an ArcGIS 9.0 personal geodatabase, comprising the UT prototype with the addition of record-level metadata and initial documentation from PBS&J.

This deliverable will be the basis for an iterative period of testing and review and incorporation of additional attributes into the geodatabase design. During the succeeding two months of iterative review no fewer than three intermediate versions will be delivered through the project team website described in the Communications Plan.

Task 2.3.1.2 Deliverable: Logical Design Documentation

One (1) electronic copy in MS Word or other MS Office format and five (5) hardcopies of District reviewed and approved logical design documentation shall be delivered to the District on a date specified in the Task 2 work plan deliverable. One (1) electronic copy of AHED logical design Visio UML file

Task 2.3.2 AHED Model Physical Design

Once logical design of the database is accomplished, Task 2 will proceed with *physical design* of the AHED, or implementation of the model and toolbox within an Oracle/SDE environment. The physical design process will assess alternate strategies for linking to time series data stored in the DBHydro database (or its future substitute, if known), as well as linking/interface strategies for other key Enterprise databases such as NEXRAIN, STORET, and NOAA. Modification made to the logical model during the physical design task will be documented and updated within the AHED UML design.

The physical design of the AHED will be based on the District's ArcSDE and Oracle systems. The ArcSDE service conveys spatial data between GIS applications and the relational database Oracle. The configuration of an ArcSDE service is based on maximizing data transfer between the server and the clients within the DISTRICT eGIS and CERP Zone. The integration and/or overlapping of these domains will be addressed as well as their clients and associated resources. The final configuration of the AHED Model will be mostly influenced by the number of applications, the number of users, and the amount of data requested by the users in these domains. Issues of data maintenance will be addressed by referencing current enterprise GIS and CERP GIS Data Management procedures.

Task 2.3.2 Deliverable: Physical Design Documentation

One (1) electronic copy in MS Word or other MS Office format and five (5) hardcopies of District reviewed and approved physical design documentation shall be delivered to the District on a date specified in the Task 2 work plan deliverable. Documentation shall include an assessment of issues encountered during the physical design process, recommendations for interface strategies for linking to time series data stored in District enterprise databases, and recommendations for implementing the model and toolbox within an Oracle/SDE environment.

Task 2.3.3 Arc Hydro Enterprise Database Implementation

The physical design process will culminate with *implementation* of the final selected AHED design that will support the development of multiple applications per the four selected projects described in Appendix A. The AHED will be implemented within the

District's Enterprise GIS environment and comply with established District GIS hardware and software configuration and standards. The UML design from Task 2.3.2 will be implemented in a pilot geodatabase within the District's SDE/Oracle environment. The Arc Hydro Tools and ArcGIS will be used to load sample data identified in Appendix A. Data sources identified in Appendix A will cover a geographic extent and provide the minimum set of data required to test and verify the functionality of the AHED framework.

Implementation and testing of the Enterprise geodatabase will be performed, and the Enterprise geodatabase will be refined and tuned. The implemented model will establish internal connectivity between features in a way that allows performance of spatial analysis functions using the AHED toolbox. A standard set of symbology for hydrographic features will be developed for the AHED layers and delivered as part of this task.

Task 2.3.3 Deliverable: Populated AHED

One (1) final electronic copy of the AHED geodatabase populated with data identified in Appendix A shall be delivered to the District on a date specified in the Task 2 work plan deliverable. PBS&J will implement, test, and demonstrate the final Task 2.3.3 deliverable onsite at the District.

Task 2.3.4: AHED Toolbox

An AHED toolbox will be developed in conjunction with the AHED geodatabase to facilitate data loading, verification, and data access. All tools must be compatible with the SFWMD's current hardware and software configurations. SFWMD is running ArcGIS 8.3 on Windows XP. This application will not be licensed and the SFWMD will own the product upon completion and acceptance. The coding will not be encrypted, but will be open for future modifications by the SFWMD. Requirements for toolbox development include the refinement of tools within the existing Arc Hydro toolbox and the development of a new set of tools for AHED population and maintenance. See list below:

Priority 1 Tools *(new tools in Italics)*
Assign HydroID
Generate From/To Node for Lines
Find Next Downstream Line
Calculate Length Downstream for Edges
Calculate Length Downstream for Junctions

Find Next Downstream Junction

Hydro Network Generation

Store Flow Direction

Set Flow Direction

Global Point Delineation Button

Import/Export by Translation Table

Update Hydro-ID

Check in/Check out Watershed

Specifications for the AHED toolbox will be developed in conjunction with Task 2.3.1 Model Logical Design. The toolbox will be implemented in conjunction with Task 2.3.2 physical design; and then tested, refined and finalized in conjunction with Task 2.3.3 AHED database implementation. AHED toolbox documentation and training will be provided. Instruction for all functions related to building and maintaining the AHED database will be covered in the training, including but not limited to translating existing data into the geodatabase, building networks, and relating features to the networks. Initial training/testing with key data stewards and power users will be conducted. A user's manual for AHED toolbox operation and database maintenance will be delivered in hardcopy Word, digital Word, and online html formats.

Task 2.3.4 Deliverable: AHED Toolbox

- Deliverable 2.3.4.1: One (1) copy of AHED toolbox specifications delivered concurrent with Task 2.3.1 deliverables.
- Deliverable 2.3.4.2: Implementation of AHED toolbox in conjunction with Task 2.3.2
- Deliverable 2.3.4.3: Testing, refinement, and implementation in conjunction with Task 2.3.3
- Deliverable 2.3.4.4: Training to be provided on-site at the District on a date specified in the Task 2 project work plan.
- Deliverable 2.3.4.5: One (1) final electronic version of the AHED toolbox including Visio UML, executables including all Visual Basic modules, and documented source code shall be delivered to the District on a date specified in the Task 2 work plan deliverable.
- Deliverable 2.3.4.6: One (1) electronic copy in MS Word or other MS Office format and five (5) hardcopies, as well as one (1) electronic html online copy of District reviewed and approved User's Manual shall be delivered to the District on a date specified in the Task 2 work plan deliverable.

Organizational Breakdown Structure:

The OBS will specify the agency, department, division, section, etc. responsible for performing each activity in the Project Management Plan. Note that in the following discussion, references are made to roles of District Coordination Team, District Stakeholders, Lead Consultant, and Consulting Chief Researcher. Personnel filling these roles, their divisions and contact information are provided in the Communication Plan below. When District Reorganization is completed, division assignments will be updated in the Project Management Plan.

1. The lead consultant, PBS&J is responsible for performing the tasks listed in the Project Management Plan and providing all deliverables.
2. The lead consultant will work with the Consulting Chief Researcher (Dr. David Maidment, University of Texas at Austin, CRWR) to resolve issues in the detailed design throughout Subtasks 2.3.1 and 2.3.2 based on the Conceptual Model and prototypes provided by CRWR.
3. The District will provide product review, input in regard to common attributes and functionality of the geodatabase, and resolution of key issues identified as being District-led issues (agreed to by the project team during detailed design as being District issues). Specific District Responsibilities will be as follows:
    a. Task 2.1 Integrated Applications Division will be responsible for providing the Development, Operating and Maintenance Environment Documentation for consultant review.
    b. Task 2.2 The project coordination team and project stakeholders listed in the communications plan (or a designated representative) will review the Coordination Meeting agenda and attend the Coordination meeting. Coordination team and stakeholders will invite additional District staff as deemed appropriate based on the agenda. District sub-committees as needed to address District-led issue resolution will provide reports at the Coordination meeting and future meetings as needed.
    c. Task 2.3.1:
        i. The District will select a team of reviewers responsible for analyzing the prototype geodatabase and ensure that they receive training in ArcGIS fundamentals of using geodatabases, and ArcGIS tools. The following feedback will be needed from reviewers:
            1. Comments/Questions on the geodatabase layout, existing attributes, domain values, and relationships.
            2. Review of attributes in current District GIS layers that are not included in the geodatabase. Identification and description of additional attributes that should be included in the shared geodatabase.
            3. Recommendations for data loading and maintenance procedures relevant to District business processes, available

data, and data stewardship. Additional comments at the reviewers' discretion on functionality and ease of use.

ii. The District will select an Integrated Systems Division team member responsible for providing access to ArcGIS 9.0 software to the review team.

d. Task 2.3.2: The Project Coordination team will assign an Integrated Systems Division team member responsible for providing ArcSDE 9.0 development environment for PBS&J to install and test the physical implementation., as well as access to key District RDBMS resources such as DBHydro and Radar-adjusted Rainfall databases for testing, building views, etc.
e. Task 2.3.3: Same as 2.3.2
f. Task 2.3.4: The District review team will be given the opportunity to test the Arc Hydro Tools following training to be delivered simultaneously with Task 2.3.3. Selected key tools may be made available to team members prior to the 2.3.3 deliverable as they are completed and documented. In these cases the selected testers would provide feedback on the clarity of the documentation and efficacy of the tool.

Project Schedule Development:

The Project Schedule is provided separately in Microsoft Project format for the electronic copy and included in the hard copy as Appendix B. The project schedule will be maintained as a living document and used to track project progress as well as any changes to the project management plan and schedule during the life of the project.

Project Cost Estimating:

See Project Cost Breakdown Spreadsheet—Appendix C. Consultant cost estimates only. SFWMD staff costs are not included.

Project Budget/Funding Requirements:

Project Budget for AHED Task 2 consulting costs are covered under SFWMD Contract # C-C20105P-Workorder 3. Workorder 3 is based on consultant cost estimates for AHED Tasks 1-3 and is co-funded by project stakeholders, with project funds distribution determined internally by the District. In order to accelerate the overall project start date, implementation of Workorder 3 was initially restricted to Task 1. Task 2 is implemented under Workorder 3, Revision 1 (C-C20105P-WO3R1).

Project Management Risk Plan:

The primary vehicle to address risks to the project will be the issue log described in the communication plan. The issue log provides a means to address all issues that impact the project by defining the issue, assigning resources to address it, assigning a due date based on impact and project dependencies, and tracking the resolution in a common project management tracking database/spreadsheet. As noted in the communications plan, issues can be identified by any team member. Issues that cannot be resolved on the spot at team meetings or in e-mail exchanges will be added to the issue log. Resources will be assigned and deadlines set by the Internal Project Task Manager in cooperation with the Internal Project Manager and the Consultant Project Manager.

Change Control Procedures:

Updates *are defined as changes to the Project Management Plan that occur on a regular basis and do not substantially modify the schedule, cost, or annual work plan for the project. Updates may be made at any time by the Project Manager and reported at each organization's regularly scheduled reporting or status briefing.*

Project Management Plan revisions *are defined as changes that reflect significant changes in the project scope, schedule, cost and/or annual work plan. Project Management Plan revisions may be scheduled or unscheduled depending on the nature of the change and/or occurrence of a significant event/milestone or phase of project development. Revisions to the Project Management Plan will require formal approval by the Sponsor and/or Management Oversight Committee*.

Quality Review Procedures:

Quality review procedures include identifying the quality review team members and their areas of expertise relating to this project and a schedule of quality reviews tied to milestones and significant project activities. The Internal Project Task Manager and the Internal Project Manager will be responsible for quality review procedures as part of the overall District review and feedback process during detailed geodatabase development. Findings of quality reviewers will be provided to the Consulting team members through the Internal Task Manager. The consulting project manager will provide a response within three working days addressing the comment and providing a resolution plan if needed.

Communications Plan:

Purpose

This document will be used to guide communication activities for the Enhanced ArcHydro Enterprise Database (AHED) Detailed Design and Implementation at the District. It outlines communication objectives for the project and how those objectives will be met for Task/Deliverable 2 of the SFWMD and PBS&J SOW. In addition the plan is expanded to encompass cross-task communication needs for parallel AHED tasks 3-5, described below, that are coming under contract or will soon be under contract.

Overview

The primary purpose of the AHED Task 2 is to provide a working prototype geodatabase to support the common needs of project stakeholders listed below, and an ArcGIS 9.0 Extended ArcHydro toolbox for populating and managing the geodatabase. SFWMD Project Stakeholders (primary contact listed) are:

- **District Stakeholders**
    - Kissimmee Restoration/Hydroperiod Analysis (Chris Carlson)
    - Flood Mitigation, using C-4 basin as example dataset (Ken Konyha)
    - Operations Decision Support System (Ken Stewart)
    - Regional Simulation Model (Jayantha Obeysekera represented by Jenifer Barnes)
- **District Coordination**
    - Integrated Applications Division (Jim Cameron- Project PM, Michele Maierhofer- AHED Task 2 Manager; AHED Task Coordinator).
- **External Team Leaders:**
    - PBS&J (Jack Hampson, CMS, Project Manager)
    - University of Texas Center for Research in Water Resources (Dr. David Maidment)
    - Task 3 – Danish Hydraulic Institute – DHI – Michael Blongewicz

Stakeholder contacts, including all team members, are listed at the end of this document.

Additional Tasks will be implemented in parallel with Task 2. These tasks address individual stakeholder needs for Hydroperiod Analysis (Task 3), Flood Mitigation Topo and Model data repository with QA/QC tools, procedures and standards (Task 4), and Operations Decision Support System AHED integration (Task 5). Tasks 3-5 will have a Task manager while the District's Integrated Applications Division will provide the

overall AHED Project Manager (Jim Cameron) and AHED Task Coordinator (Michele Maierhofer).

Approach

- The following approach has been developed to ensure that communication is consistent and effective. Included in the communication plan are the procedures for joint development and version control of the geodatabases and the toolset.
    - A central project website will be established for posting in one place all important information relating to the AHED project, for all current and future tasks. This is to include, but not be limited to project schedules, statements of work, a common calendar, contact information for all team members, meeting summaries, links to other important websites (such as CRWR) and deliverables including geodatabases and tools. The project website will support all active and former Tasks associated with the AHED project and will be accessible via login and password to both internal and external participants over the Internet.
    - Version Control will be handled as follows:
        - Geodatabases and Toolsets will be assigned versions based on the date. The version will be a six-digit date represented by 2-digits each in the following order: yearmonthday e.g. 040206 for February 6, 2004. If the need should arise for two versions on one day, the second version will have a -2 added to the end of the number, as in 040206-2. (For those who are wondering, this sequence will sort chronologically in a standard alphanumeric sort).
        - Draft and Deliverable text files will include the date and page number in the footer and the six-digit date in the filename as described in the previous bullet e.g. CoordinationSummary040206.doc
    - Meetings: Weekly Internal Project Team Meetings will be conducted to review project progress and conduct project business. PBS&J and UT will be invited to attend via conference call at the discretion of the internal team members. Project meetings requested by PBS&J and/or UT will be scheduled to coincide with the Wednesday afternoon timeframe whenever possible. All Project Meetings will be followed up with a summary by the Internal Task Manager (or PBS&J if present) listing key issues discussed and decisions made. The summary will be distributed no later the third workday following the meeting. All team members will be copied on the report and will have an opportunity to respond. Typically, internal team responses to PBS&J and UT products will be discussed at weekly internal

team meetings and responses summarized by the Internal Task 2 Manager (Michele Maierhofer) and delivered via e-mail.

- E-mail: The Integrated Applications Division AHED Task Coordinator (Michele Maierhofer) will act as an e-mail archive/coordinator for the project and shall be copied on all Internal emails relating to Tasks 2-5 and on emails between Internal and External team members. All e-mail will be copied Draft Project Deliverables will be followed by presentations to the team of the results and summaries of the deliverable with opportunity for discussion. Draft reports and intermediate deliverables will be provided for review prior to Wed. Team Meetings no later than Monday at 9 a.m. Deliverables that require longer review periods are included in the project schedule and are so noted.
- Telephone Conversations: All team members are free to contact other team members directly when deemed necessary to achieve clear communication. However, all phone conversations in which any substantive issues are raised or decided should be followed up with an e-mail from the call originator to the call participants confirming mutual understanding of the outcome, copying at minimum the Internal Task Manager if not a phonecall participant, and the AHED Task Coordinator (Michele Maierhofer). Any responses from call participants should also copy the Task Manager and AHED Task Coordinator.
- Issue Log and Action Item Log: A log will be maintained by the Internal Task Manager of all issues raised that require District input or Consultant resolution and their status during the Task 2 development period. The standard form for the Action Items includes an issue number; Origination Reference; description; Owner; Log Date, Target Completion Date, Actual Completion Date, Comments. Larger Issues that are addressed by one or more Action Items will also be summarized in an Executive Summary Issue Log containing: Issue number, Topic, Description, Issue and Decision. PBS&J and UT will also contribute to the logs through the Task Manager. The logs will be posted on the team access website – http://www.sfwmd-ahed.net.

AHED Project Team Contacts

First	Last Name	Organization	Phone	E-mail	Comment
Mark	Aurit	PBS&J	813-282-7275 x480	mdaurit@pbsj.com	PBS&J Geodatabase Design
Michael	Blongewicz	DHI	+45 45169285	mjb@dhi.dk	GIS Application Dev/TimeSeries
Jenifer	Barnes	SFWMD	561-682-6943	jabarne@sfwmd.gov	OOM/RSM Point of Contact
Clay	Brown	SFWMD	561-682-2256	mcbrown@sfwmd.gov	OOM/MDD
Jim	Cameron	SFWMD	561-682-6037	jcameron@sfwmd.gov	Int. Appl'n Div. Director; AHED Project Mgr
Chris	Carlson	SFWMD	561-682-6143	Ccarlson@sfwmd.gov	Kissimmee Div.
Prasad	Chittaluru	PBS&J	407-647-7275	PVChittaluru@pbsj.com	PBS&J Orlando PM
Suelynn	Dignard	SFWMD	561-682-6589	sdignard@sfwmd.gov	Flood Modeling (C-4 Basin Proj.)
Eric	Flaig	SFWMD	561-682-6845	eflaig@sfwmd.gov	RSM Application
Alicia	Fogg	UT Austin	512-471-0073	adfogg@engmail.uwaterloo.ca	GS working on ODSS
Jack	Hampson	PBS&J	813-282-7275x251	jchampson@pbsj.com	PBS&J PM
Ken	Konyha	SFWMD	561-682-2024	Kkonyha@sfwmd.gov	OOM/Flood Modeling (C-6)
Steve	Lin	SFWMD	561-682-6512	slin@sfwmd.gov	Kissimmee Div.
David	Maidment	UT Austin	512-471-0065	maidment@mail.utexas.edu	Director, CRWR
Michele	Maierhofer	SFWMD	561-682-6056	mmaier@sfwmd.gov	Integrated Apps AHED Task Coordinator; AHED Task 2 Manager
Dante	Marzetti	SFWMD	561-682-2787	dmarzet@sfwmd.gov	GIS Systems Administrator
Raul	Mercado	PBS&J	561-689-7275	rmmercado@pbsj.com	C-4/C-6 Modeling PM; Contract Mgr.
Ron	Mierau	SFWMD	561-682-	rmierau@sfwmd.gov	ODSS
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Paul	Ryan	SFWMD	561-682-6110	pryan@sfwmd.gov	ODSS Programming
Valerie	Sackey	SFWMD	561-682-6192	vsackey@sfwmd.gov	Sr. Infrastructure Analyst
Jennifer	Sorenson	UT Austin	512-471-0073	sorenson@mail.utexas.edu	GS working on Hydroperiod
Ken	Stewart	SFWMD	561-682-2749	kstewart@sfwmd.gov	ODSS PM
Jeff	Sullivan	SFWMD	561-682-6342	jsulliva@sfwmd.gov	OOM GIS/Geographer
Yurong	Tan	SFWMD	561-682-2782	ytan@sfwmd.gov	GIS, Lead Geographer
Brian	Turcotte	SFWMD		bturcott@sfwmd.gov	ODSS
Randy	VanZee	SFWMD	561-682-6524	rvanzee@sfwmd.gov	RSM Programming

Project Closeout Procedures:

Final project closeout activities include closeout of any contracts associated with this project, final audits, financial accounts balancing, and notice of project completion.

Acceptance Criteria: **The following system acceptance criteria will be used to define project milestones for completion.**

- Task 2.1 - Environment Overview Document Review – System Optimization: to be reviewed and accepted by the District Project Manager.
- Task 2.2 – Final Project Workplan and Schedule – to be reviewed by District Project Team (Four Projects) and accepted by District Project Manager.
- Task 2.3 – Enhanced Arc Hydro Detailed Design and Toolbox Specifications – To include all items specified in the Final Project Workplan and all tools agreed to in Task 2 Scope of Work. These include the detailed Unified Modeling Language (UML) version of the geodatabase with all attributes defined. The UML must be capable of being exported to a Microsoft Repository and implemented in the Oracle/SDE environment at SFWMD.
- Task 2.3.2 – Physical Design Document detailing the implementation plan for Enhanced Arc Hydro and the selected Tools in the SFWMD Enterprise. The District Project Manager will review and approve the Physical Design Document.
- Task 2.3.3 – Enhanced Arc Hydro populated with example data as identified in Section 2.5 and Tools as specified in the Task 2 Scope of Work will be demonstrated at the SFWMD after installation and testing on a SFWMD development server. System acceptance will be defined by a functional geodatabase implementation from the approved UML and populated with the specified sample data and tools demonstrated and operational accompanied by an online Tools and Procedures User Manual. The populated database will met the following expectations:
    - Multiple schematic networks compatibly coexist and operate within the AHED framework.
    - Hooks and links incorporated into the AHED provide required connectivity and record-level metadata structure
    - The AHED is populated with consensus datasets outlined in Appendix A
    - The AHED connects to other DBMS
    - The AHED has the capability to be extended for subsequent task application development.

AHED Task 2 Project Management Plan Appendices

Appendix A: Data Sets and Geographic Extents For Prototype

Appendix B: Project Schedule

Appendix C: Project Cost Breakdown